

Appl. No. 09/681,304  
Arndt. Dated 9 May 2003  
Reply to Office action of 12 February 2003

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Appl. No. : 09/681,304  
Applicant : R.J. Saia et al.  
Filed : 16 March 2001  
Title : Microelectromechanical System Device Packaging Method  
TC/A.U. : 2814  
Examiner : Nguyen, Dilinh P  
Docket No. : RD28435-2

Commissioner for Patents  
PO Box 1450  
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*Response*  
*#15*  
*5-18-03*  
*J. Antweiler*

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#### RESPONSE UNDER 37 CFR 1.111

In response to the Office action of 12 February 2003, please consider the following remarks.

#### REMARKS/ARGUMENTS

In the Office action dated 12 February 2003, claims 1-4, 6 and 16 were rejected under 35 USC 103(a) on Gorowitz et al., US Patent No. 5,757,072 (hereinafter Gorowitz) in view of Noddin, US Patent No. 5,731,047 and further in view of Centofante, US Patent No. 5,833,903 (newly cited); and claims 7-8 and 19 were rejected under 35 USC 103(a) on Gorowitz and Noddin and further in view of Takeuchi et al., US Patent No. 5,522,006 (newly cited and hereinafter Takeuchi). Claims 5, 9-15, 17-18, and 20-25 were canceled in earlier amendments.

Claims 1-4, 6-8, 16, and 19 remain in this application.

#### Claims 1-4, 6, and 16

Independent Claim 1 (from which claims 2-4 and 6 depend) and independent claim 16 define allowable subject matter over Gorowitz, Noddin, and Centofante.

Independent claim 1 recites: "using a partially-cured adhesive to attach a release sheet to a MEMS package flexible layer" and "providing a cavity having a smooth surface perimeter and extending through the

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release sheet and at least partially through the MEMS package flexible layer." Independent claim 16 recites: "partially curing the adhesive," "using the adhesive to attach a release sheet to the MEMS package flexible layer," and "providing a cavity having a smooth surface perimeter and extending through the release sheet, the adhesive, and at least partially through the MEMS package flexible layer." A smooth surface perimeter is useful for the reasons stated in paragraph 16, lines 3-11, of Applicants' Specification:

"Smooth-surfaced perimeter" is meant to encompass any perimeter without sharp edges (such as 90 degree corners in square or rectangular perimeters). Examples of smooth-surfaced perimeters include ovals, circles, rounded rectangles as shown in FIG. 3, or other straight line perimeters having rounded corners or corners of greater than 120 degrees, for example. Smooth-surfaced perimeters are useful for evenly distributing any excess adhesive that is close to the surface of MEMS structure 22. Harsh-surfaced perimeters such as 90 degree corners create the potential for localized stress and excess flow of adhesive (and thus the potential for interference with MEMS structure 22).

Gorowitz appears to relate to deposition of a protective cap 16 over an air bridge structure of an integrated circuit chip.

Noddin appears to relate to a method of forming a blind via in a laminated substrate using a plurality of laser pulses (abstract) and was cited in the office action in regards to column 31, lines 10-15:

The partially-cured adhesive composite thus produced comprised of 57 weight percent TiO<sub>2</sub>, 13 weight percent PTFE and 30 weight percent epoxy adhesive. Several plies of the adhesive sheet were laid up between copper foil and pressed at 600 psi in a vacuum-assisted hydraulic press at temperature of 225 °C. for 90 min.

Centofante appears to relate to injection molding of a thermoplastic material over small electronic devices (abstract) using holes in the substrate to promote bonding of the encapsulating material (column 6, lines 34-37), or raised members or recesses for similar bonding purposes (column 7, lines 5-30). The Office Action cites column 9, lines 26-40 which state:

Referring to FIG. 2-9, the shape of cavity 24 and gate 21 may be seen in detail. The shape of cavity 24 is chosen to provide a package of hardened encapsulating material (34 of FIG. 2-3) that completely encloses LED 32 and fills hole 31. Cavity 24 may, however, be of any shape, and the shape will depend on the particular device being enclosed. The cavity may, for example, be substantially rectangular, or round, or trapezoidal at its base and taper to the output of its corresponding gate which itself may be, for example, round, square, triangular, rectangular, or oval. As shown, gate 21 is conical in shape with a substantially round input and substantially round output. However, gate 21 also may be of any shape and may, for example, be pyramid-shaped, substantially rectangular in cross-section, or the like.

Applicants fail to understand why the facts that shaping a molding cavity of Centofante can be done in any manner and that the cavity is shown as being a shape which appears to facilitate light transmission from LED 32 (FIG. 2-11) have any relation to the shape of a cavity through a release sheet for a packaging application wherein the underlying flexible layer will be attached to a MEMS device. Therefore, Applicants submit that one of ordinary skill in the art would not have been motivated to use the teachings of Centofante to modify Gorowitz or Noddin in any manner to arrive at Applicants' claimed invention.

Accordingly, Applicants respectfully submit that claim 1, claims 2-4 and 6 which depend therefrom, and

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claim 16 defin allowable subject matter over the applied art. Withdrawal of the rejections is respectfully requested, and allowance of the claims is respectfully solicited.

Claims 7-8 and 19

Claims 7 (from which claim 8 depends) recites "providing a protective coating in the cavity" and "then removing the release sheet." Claim 19 (which depends from above discussed claim 16) has similar recitations.

As described in paragraph 17, the process of claim 7 results in protective coating remaining only in the cavity. Thus, the order of events permits the protective coating to be easily blanket-sputtered and easily removed so as to remain in the desired location.

As stated above, Gorowitz appears to relate to deposition of a protective cap 16 over an air bridge structure of an integrated circuit chip, and Noddin appears to relate to a method of forming a blind via in a laminated substrate using a plurality of laser pulses (abstract) and was cited in the office action in regards to column 31, lines 10-15. No combination of Gorowitz and Noddin describes providing the protective coating in the cavity, removing the release sheet and attaching the MEMS device ... with a MEMS structure positioned in the cavity.

Newly cited Takeuchi does not overcome these deficiencies. Takeuchi does not appear to relate to MEMS devices or integrated circuit packaging. Instead Takeuchi relates to a coupler between an endoscope's light guide and a light source (abstract). Sealing material 34 (FIG. 3 and column 5, lines 54-66) is in place so that the assembly can be washed after patient use. No release sheet is described. The alleged motivation of seal tightness still does not explain the motivation of providing a coating and then removing the release sheet.

For this reason, Applicants respectfully submit that, even if one were to assume that the teachings or suggestions of Gorowitz, Noddin, and Takeuchi were to be combined, no combination of the references teaches or suggests these claim recitations.

As stated in Applicants' most recent amendment, the specific motivation for applying the coating prior to removing the release sheet is not shown in the Office Action. As described in paragraphs 17-18 of the Specification, this ordering is useful for permitting blanket application of the protective coating which will then only remain in the cavities after removal of the release layer. As also stated in Applicants' last amendment, this feature would be difficult to realize with the Gorowitz embodiment. Page 3 of the Office Action characterizes element 32 as a Kapton polyimide film in an attempt to fit it into Applicants' characterization of a "release sheet." Gorowitz however, calls element 32 a "hard mask layer" (column 9, line 3) with examples being metals which typically require etching for removal (see column 9, lines 5-15).

Accordingly, Applicants respectfully submit that claim 7, claim 8 which depends therefrom, and claim 19 define allowable subject matter over the applied art. Withdrawal of the rejections is respectfully requested, and allowance of the claims is respectfully solicited.

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Summary

In view of the foregoing, applicants respectfully request that a timely Notice of Allowance be issued in this case..

Should the Examiner believe that anything further is needed to place the application in even better condition for allowance, the Examiner is requested to contact applicants' undersigned representative at the telephone number below.

Respectfully submitted,

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